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Motor resonance during movement observation in Parkinson's disease assessed by functional near-infrared spectroscopy-EEG corecording

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Introduction: The mirror neuron system (MNS) includes a group of neurons that discharge both when a movement is executed and observed [1]. Recent studies have shown that subtalamic nucleus might be involved in mirror circuit activity [2]. The Mu-rhythm event-related desynchronization (ERD) during observed movement has been suggested to be an indicator of MNS activity; it can be impaired in PD, even at the early stages of the disease [3].

Objectives: To investigate changes in oxy- and deoxyhemoglobin concentration and EEG activity in motor cortical areas at rest and during movement observation and execution, in PD patients and healthy subjects.

Materials and Methods: We enrolled 21 healthy subjects and 21 PD patients, all right-handed. Inclusion criteria for PD patients were age between 40 and 80 years, MMSE>23, absence of significant visual deficits and diagnosis of Idiopathic PD at Hoehn-Yahr stage I-II. FNIRS-EEG were co-recorded using 20 fNIRS measurement channels on motor areas and a 61 scalp electrodes EEG. During the observation session participants were asked only to observe videos in which a woman grasped a flat object or a sharp tip object. During the execution session participants had to tap a bar on the keyboard when the agent touched the object on the watched video.

Results: In parkinsonian patients' motor cortex two different patterns were noted: hypermetabolism with desynchronization during observation of grabbing flat object and hypometabolism with hypersynchronization during observation of grabbing sharp tip object. The control group, on the contrary, exhibited a specular activation pattern. We found significantly higher mean levels of oxyhemoglobin in PD patients during the resting state but no differences between the two groups in touch detection time during the execution session.

Conclusions: Training techniques such as action observation and motor imagery have recently gained attention as a promising rehabilitation tool for patients with neurological disorders [4]. Motor resonance mechanisms could compensate the abnormal motor planning in early PD, supporting specific rehabilitation strategies.

References:

[1] Alegre M, Guridi J, Artieda J. The mirror system, theory of mind and Parkinson's disease. Journal of the Neurological Sciences. 2011; vol. 310, no. 1-2, pp. 194–196.
[2] Alegre M, Rodrıguez-Oroz MC, Valencia M et al. Changes in subthalamic activity during movement observation in Parkinson's disease: is the mirror system mirrored in the basal ganglia? Clin Neurophysiol. 2010; vol. 121, no. 3, pp. 414–425.
[3] Heida T, Poppe NR, de Vos CC, van Putten MJ, van Vugt JP. Event-related mu-rhythm desynchronization during movement observation is impaired in Parkinson's disease. Clin Neurophysiol. 2014 Sep; 125(9): 1819-25.

[4] Abbruzzese G, Avanzino L, Marchese R, Pelosin E. Action Observation and Motor Imagery: Innovative Cognitive Tools in the Rehabilitation of Parkinson's disease. Parkinson Dis. 2015; 2015: 124214.